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CTS CORPORATION
RESEARCH & DEVELOPMENT DIVISION
ELKHART, INDIANA

PRODUCTION ENGINEERING MEASURE FOR
SUBMINIATURE, TRANSISTOR TYPE POTENTIOMETERS

SEVENTH QUARTERLY PROGRESS REPORT
REPORTING PERIOD 1 JANUARY 1963 TO 31 MARCH 1963
CONTRACT NO. DA 36-039-SC-85976
ORDER NO. 6031-PP-61-81-81
PLACED BY IND. PREP., USASSA, PHILADELPHIA, PA.

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SUBMINIATURE, TRANSISTOR TYPE POTENTIOMETERS

SEVENTH QUARTERLY PROGRESS REPORT

REPORTING PERIOD:	1 January 1963 to 31 March 1963
OBJECTIVE OF STUDY:	Establish a Production Line to Produce Reliable, Subminiature Potentiometers
CONTRACT NUMBER:	DA 36-039-SC-85976
ORDER NUMBER:	6031-PP-61-81-81
SPECIFICATION NUMBER:	SCS 112
PREPARED BY:	D. C. Kinsey C. L. Holmes
APPROVED BY:	C. W. Hartman Contract Administrator

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ABSTRACT

This report covers a detailed account of the work performed during the three months of the seventh quarter of this contract (1 January 1963 to 31 March 1963).

The progress made in the various steps of assembly is outlined for the 2400 controls being fabricated for the reliability study and the 1800 controls for preproduction testing against Specification SCS-112. To-date, more than 1000 flat mount and bushing mount controls have been fabricated.

CTS requested changes in the delivery time and a change in the rotational torque requirement.

I. PURPOSE

The primary purpose of this contract is to establish the producibility of a 3/8" diameter subminiature, transistor size, general purpose potentiometer. The overall purpose is divided into various steps. These steps cover the design, testing and qualification of a highly reliable, high production-type subminiature potentiometer; the development of the processes, procedures and techniques necessary to economically produce these items in quantity; the design and development of special equipment for production, and the carrying out of a production pilot operation in which 1350 potentiometers are fabricated. In addition to the potentiometers, drawings of the equipment developed, information on manufacturing techniques, and specifications of the potentiometers will be submitted as end products of the contract. Piece part and assembly tooling for this contract are being provided by CTS Corporation, Elkhart, Indiana and CTS of Berne, Inc., Berne, Indiana and, therefore, title to all equipment will remain with the contractor. The main objective of this contract is the establishment of an unbalanced production line with a potential of 3750 completed units per 40-hour week. During the course of this contract, over 4300 controls will be tested in accordance with specification SCS-112 and Contract No. DA 36-039-SC-85976.

II. NARRATIVE AND DATA

A. CONTRACTUAL REQUIREMENTS

CTS Corporation, Elkhart, Indiana and CTS of Berne, Inc., Berne, Indiana shall furnish the necessary personnel, facilities, materials, services, and supplies to conduct a Production Engineering Measure to design, tool, produce, and test the following two styles of single turn, cermet element variable resistor controls rated at 1/4 watt at 125°C, derated to zero wattage at 160°C with failure rate as a function of temperature and wattage:

Style RV8, bushing mount, 3/8" diameter, 1/4 watt,
50 ohms through 25K ohms

Style RV9, flat mount, 3/8" diameter, 1/4 watt,
50 ohms through 25K ohms.

The Industrial Preparedness Contract is divided into four distinct and separate steps which are outlined in Item 1.2.2.2 of SCIPPR No. 15.

B. FABRICATION OF TEST CONTROLS

Fabrication of piece parts, sub-assembly operations and final assembly operations have been under way during this reporting period. To date, fabrication of the following piece parts has been completed along with calculated overruns.

<u>Bushing Mount Control</u>		<u>Flat Mount Control</u>	
<u>Part</u>	<u>No. Required</u>	<u>Part</u>	<u>No. Required</u>
Base	3300	Base	900
Ground Plate	3300	Ground Plate	900
Center Terminal	3300	Center Terminal	900
End Terminals	6600	End Terminals	1800
Shaft	3300	Shaft	900
Drive Arm	3300	Drive Arm	900
Contact Spring	3300	Contact Spring	900
Shaft Retainer	3300	Contact Button	900
Contact Button	3300	Housing	900
Housing	3300	Stop Pin	900
Stop Pin	3300	"O" Ring(inside)	900
"O" Ring(outside)	3300		
"O" Ring(inside)	3300		

Sub-assembly operations completed to date include preparation of the cermet resistor element, the attachment of the terminals to the element and the completion of the contact mechanism-drive arm sub-assembly operation.

Final assembly operations are now in progress and the establishment of an unbalanced production line has been realized. Speed of production is gradually increasing as experience is gained on repetitive operations.

Controls which have been fabricated to date for quality assurance testing toward SCS-112 specifications are listed in Table I.

TABLE I

CONTROLS FOR QUALITY ASSURANCE TESTING

Resistance Value	Style	Quantity Required	Quantity Assembled
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PREPRODUCTION TESTING

50 ohm	Flat Mount	300	0
50 ohm	Bushing Mount	300	0
5000 ohm	Flat Mount	300	175
5000 ohm	Bushing Mount	300	200
25000 ohm	Flat Mount	300	266
25000 ohm	Bushing Mount	300	194

RELIABILITY EVALUATION

25000 ohm	Bushing Mount	2400	489
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C. SPECIFICATION CHANGES

1. Rotational Torque: Technical Action request No. 2 submitted by CTS Corporation to USASEMA, Field Engineering Division, Fort Monmouth, New Jersey, requested a change in the rotational torque requirement from 2 - 6 ounce-inches to 1 - 5 ounce-inches for the bushing mount control and from 4 - 8 ounce-inches to 1 - 5 ounce-inches for the flat mount controls. This request was accepted. Requests were also submitted for changes in the reliability test, moisture resistance, and rotational life test; these requests were denied and will remain as specified in SC-112.

2. Pilot Production Acceptance Testing

Sub-Item 1 - 3 of the contract did not have provisions for acceptance sampling or testing of the pilot production run. The following action was recommended by the Production Development Division. (TAR No. 3 dated 21 February 1963).

a. For Group I Tests - AQL 1.5 DPHU Major, 4.0 DPHU Minor.

For Group II Tests - AQL 4.0 DPHU, Inspection Level 1-8 of MIL-105.

For Group III Tests - to be performed monthly on at least 2 units (one of each type) or 1% of monthly production, whichever is greater.

- b. Each lot shall be subjected to the sampling required for Group I Tests. From each lot that has been accepted for Group I Requirements, one set of sample units shall be selected for Group II and another set selected for Group IV Tests.
- c. The samples required for the Group III Tests may be selected at any convenient time from any lot that has passed the Group I Tests. In the event of failure in Group IV Tests, the contractor shall immediately investigate the failure to determine its cause and to correct, where possible, any other units that may be defective in like manner.

3. Contract Delivery Schedule

As a result of the extensive time and effort spent in designing, testing, re-designing and retesting the two styles of controls specified on this contract, an extension in the contractual delivery schedule was requested as follows:

<u>Item No.</u>	<u>Schedule</u>
Preproduction Samples	On or before 30 September 1963
Pilot Run Quantities	On or before 30 December 1963
Monthly Progress Report	Until completion of contract
General Report for Step II	On or before 30 June 1964
Quarterly Reports	Until completion of contract
Final Report	On or before 30 August 1964
Reliability Study	On or before 30 July 1964

D. PREPRODUCTION TESTING

All data sheets for Preproduction In Plant Testing have been prepared. All test equipment is installed and ready. Several new pieces of test equipment have been purchased by the Testing facilities and permission may be requested to use this equipment on the Preproduction Tests.

III. CONCLUSIONS

Fabrication of bushing mount and flat mount controls for quality assurance testing is being carried out using unbalanced pilot line facilities. A total of 1324 controls have been assembled to date.

The rotational torque specification was reduced from 4 - 8 oz.in. on the flat mount unit and from 2 - 6 oz.in. on the bushing mount, to 1 - 5 oz.in. on both controls.

A method of sampling and testing pilot production controls was recommended by CTS Corporation and accepted by the U. S. Army Electronics Materiel Support Agency.

All test facilities are ready to begin the Quality Assurance Testing. Testing will begin as soon as the controls are assembled.

IV. PROGRAM FOR NEXT PERIOD

- A. The balance (2876) of the controls for Quality Assurance Testing will be fabricated.
- B. Notification will be made to USASIMSA that Preproduction Testing is ready to begin.
- C. Quality Assurance Testing of the 4200 controls will begin.

V. BIOGRAPHIES OF KEY PERSONNEL

Biographies of most of the key personnel working on this contract have been presented in previous reports. The following pertain to individuals who have been assigned to this program recently because of the increased scope of activity.

HAROLD E. GRAY, JR.

Ceramic Engineer -
Shipping Dept. Foreman
CTS of Berne, Inc., Berne, Indiana

Education: Received his B. S. Degree in Ceramic Engineering from Rutgers University in 1948

Experience: 1948 - 1953 Ceramic Research Engineer at
B. G. Corp.

1953 - 1954 Ceramic Methods Engineer at
B. G. Corp.

1954 - 1955 Superintendent of Finishing
Div. at B. G. Corp.

1955 - 1956 Ceramic Engineer at Arketex
Ceramic Corp.

1956 - 1957 Assistant Superintendent at
Arkhetex Ceramic Corp.

1957 - 1959 Ceramic Engineer at CTS

GEORGE A. PAULEY

Manufacturing Superintendent
CTS of Berne, Inc., Berne, Indiana

Education: Attended high school

Experience: 1940 - 1945 Employed at CTS in Sub-
Assembly, Maintenance,
Element, Automatic, and
Assembly Departments on
various assignments.

1945 - 1953 Group Leader in Assembly
Dept. at CTS.

1953 - 1959 Foreman in Assembly Dept.
at CTS.

1959 - 1960 Transferred to CTS of
Berne, Inc. as Production
Superintendent

JACOB SPOOR

Director of Quality Control
CTS of Berne, Inc.

Education:

H. B. Plant High School, Tampa, Florida -
General Education - 1954
Franklin University, Columbus, Ohio;-
Communications Major - 1958
Received Associate of Science degree
in August 1959
Indiana Technical College, Fort Wayne, Ind.
Electronics Major - 1960
Bachelor of Science Degree - December 1962

Experience:

1953 - 1957 Electrical Repair-U.S. Air Force
1957 - 1958 Radio & Television Repair for
McCleery Carpenter Electric Co.
1959 - 1960 Quality Control Laboratory
Technician for Bell Sound,
Columbus, Ohio
1961 - 1962 Electronic Technician for
Research and Development Lab-
oratories, Indiana Technical
College, Fort Wayne, Indiana
1963 CTS of Berne, Inc., Berne, Ind.
Quality Control - Director.

VI. HOURS OF WORK PERFORMED
BY CTS PERSONNEL DURING SEVENTH QUARTER

	<u>HOURS</u>
 A. <u>Project and Production Engineers</u>	
G. Erekson	9.0
D. Kinsey	383.0
G. Francis	6.0
H. Gray	1.0
C. Holmes	64.0
 B. <u>Testing Department</u>	
Engineers	
J. Massoth	48.0
J. Kirkdorffer	8.5
J. Spoor	1.0
*Technicians	33.0
 C. <u>Manufacturing Department</u>	
Supervisors	
H. Moderau	16.5
J. O'Dell	25.7
R. Hall	3.0
H. Fruchte	4.5
R. Cole	47.0
S. Chung	21.2
G. Pauley	42.0
*Fabrication Personnel	2,191.9

*Denotes hours worked by non-technical personnel.

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